

THE QUR'AN AND MODERN SCIENCE: CORRELATION STUDIES

KEITH L. MOORE
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The Qur'an and Modern Science: *Correlation Studies*

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
 يَا أَرْحَمَ الرَّاحِمِينَ
 اللَّهُمَّ ارْحَمْهُمَا كَمَا رَبَّحْتَ بَيْنَهُمَا
 وَتَبَاوَسْتَ خَلْقَهُمَا وَتَوَلَّوْا بَيْنَهُمَا

“Our Lord! Thy reach is over all things, in
 Mercy and Knowledge. Forgive, then, those
 who turn in Repentance, and follow Thy Path”
 — Glorious Qur'an, Surah 40, Ayah 7

Publisher's Note

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allah, Most Gracious, Most Merciful

It is a pleasure for the Islamic Academy for Scientific Research to provide the reader with one of the very important subjects in the area of the relationship between religion and science. In Western societies it has often been thought that these two areas should be in conflict with each other, or at least that no correlation could exist between them. Historically, in fact, this conflict produced two diverging main schools, religious and rational or scientific. On one hand, societies have valued science for greater knowledge and progress, but on the other hand, religion has been valued for maintaining moral standards and ethics and for fulfilling spiritual needs, but the two areas have been considered mutually exclusive. The issue has been whether the conflict between them could be resolved.

However, the Islamic view has always been that a true revelation can only exist in harmony with proven scientific facts. Throughout Islamic history, complete harmony and agreement have existed between religion and science, and in fact, they have been considered mutually inclusive. Scientific achievements and findings progressed greatly through the strong encouragement and support by the Islamic teachings.

The two papers presented in this publication reflect this supportive relationship using very direct evidence from the Qur'an and Hadith and from the latest scientific research. The fact that a fully harmonious correlation is found to exist between the findings of modern embryology and the Islamic writings is explained as being a proof that the Qur'an is indeed a Revelation from God and that Muhammad (peace be upon him) is His Messenger.

The authors are highly regarded and well-known for their qualifications in the topics in this publication. Sheikh Abdul-Majeed A. Zindani is a very eminent Muslim scholar and has concentrated many of his efforts in these types of correlation studies during the past ten years at King Abdul-Aziz University, Jeddah, Saudi Arabia. He is also the Secretary General of the Islamic Academy for Scientific Research (Hay'at Abhath al-I'jaz al-'Ilmi fi al-Qur'an sa Sunnah).

Dr. Keith L. Moore is Professor and Chairman of the Department of Anatomy, University of Toronto, Toronto, Canada. He is a well known scientist and respected researcher in the fields of anatomy and embryology, and he is the author of several medical textbooks such as *The Developing Human* (now in its fourth edition), *Before We Are Born*, and *Clinically Oriented Anatomy*. In 1980, Dr. Moore first became aware of many aspects regarding human development which are mentioned in the Qur'an and Hadith, and since that time, has continued to develop his knowledge in this area and extensively supported this type of research in the correlation studies.

Sheikh Mustafa A. Ahmed spent several years as a lecturer on Islamic studies for the Islamic Bureau and Military College in the Yemen Arab Republic. For the past eight years he has been associated with King Abdul-Aziz University as a researcher in the area of correlation studies between the Qur'an, Sunnah, and modern science and is a representative for the Islamic Academy for Scientific Research in the United States.

The papers were presented in a symposium sponsored by the Muslim Students Association at the University of Illinois, Circle Campus on May 8, 1990. Due to the high degree of interest generated by the presentations, it was decided to publish them.

We would like to express our appreciation to the authors for their continued efforts, the administrators of the University of Illinois for their support of the symposium, and the Muslim Students Association of UIC for their recognition of the research. The great efforts offered by our associate, Mrs. Margaret B. Tobin, should also be recognized. Her participation in all aspects of the preparation of this book greatly facilitated its publication.

May, 1990

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POSITION OF SCIENCE IN ISLAM

Mustafa A. Ahmed,

Islamic Academy for Scientific Research, Makkah, Saudi Arabia

Presentation at the University of Illinois, Circle Campus, Chicago, IL, May 8, 1990

I. Introduction.

For many centuries people had mistaken ideas regarding the origin and development of the human fetus. For example, they used to think that the menstrual blood gave rise to the fetus, since they noticed a cessation of the menses during pregnancy. For that reason, they believed that the blood itself developed into the fetus. This idea was established by the Greeks and prevailed among the scientists in Europe until the invention of the microscope in the 17th century.

And, for many centuries people thought that the earth was the center of the universe. With the early development of scientific knowledge during the late Middle Ages in Europe, new ideas rejecting this information were offered. As you are aware, some scientists sacrificed their lives or their freedom as a price for searching for the truth, since their ideas were considered to be threats to established religious doctrines.

History and life are filled with similar examples that result in a general rule. That rule is that the truth will eventually dominate and will conquer and replace the false beliefs and concepts, even if some difficulties are initially present. The Qur'an emphasizes this rule in many passages, as in the following examples:

«بَلْ نَقْذِفُ بِالْحَقِّ عَلَى الْبَاطِلِ قَيْدَمَةً فَإِذَا هُوَ ذَاهِقٌ» (سُورَةُ الْأَنْبِيَاءِ : آيَةُ ١٨)
"Nay, We hurl the Truth against falsehood, and it prevails over it, behold falsehood perishes!" (Surah Al-Anbiya, 21: Ayah 18)

«وَقُلْ جَاءَ الْحَقُّ وَزَهَقَ الْبَاطِلُ إِنَّ الْبَاطِلَ كَانَ زَهُوقًا» (سُورَةُ الْإِسْرَاءِ : آيَةُ ٨١)
"And say: 'Truth has come, and Falsehood perished: Surely Falsehood is ever certain to perish.'" (Surah Al-Isra', 17: Ayah 81)

The reason for this result is explained in the following passage:
 «مَا خَلَقْنَا السَّمَاوَاتِ وَالْأَرْضَ وَمَا بَيْنَهُمَا إِلَّا بِالْحَقِّ وَأَجَلٍ مُّسَمًّى، وَالَّذِينَ كَفَرُوا عَمَّا أُنذِرُوا مُّعْرِضُونَ» (سُورَةُ الْأَحْقَافِ : آيَةُ ٣)

"We created not the heavens and the earth and all between them save with Truth, and for a term appointed: But those who reject Faith turn away from that whereof they are warned." (Surah Al-Ahqaf, 46: Ayah 3) Therefore, one expression of the Truth is in the laws controlling the entire creation, and any falsehood works against these laws. If this rule did not exist in the universe, your efforts and the efforts of all scientists and researchers would be useless. Why? Because in such a situation, there would be no way to distinguish the truth from falsehood, and the truth would not be dominant. There would be no way to realize that those who are conveying false ideas are going against the system and laws of the universe.

The truth will remain and become known, in spite of difficulties against it during a specific age or in a specific location. With time, more development, progress and achievement will be obtained in the sciences and general knowledge, as well as in the area of belief and religious concepts. The true, correct facts will become established.

I think you will realize with me that the understanding of Islam, as a religion and way of life, passed through some of these types of difficulties in the past in Western societies. Many misconceptions regarding Islam were propagated through ignorance and sometimes through intentional efforts made by those who felt threatened by its

teachings. However, with recent developments in rapid communications and world travel, in addition to the more honest and objective approaches for study and analysis, many difficulties against Islam have been removed, and a truthful understanding of the religion is now developing in the West. Our meeting today at The University of Illinois is evidence for that.

II. Essential definitions.

The following definitions are helpful in understanding the topics presented today:

Islam: The linguistic meaning of the word Islam is surrender and submission. Therefore Islam means the complete submission and obedience of man before Allah (God, Glory be to Him), and it is the religion of all Prophets and Messengers as well as a universal Message for all humanity.

Allah (God): He is the Creator and Sustainer of the universe and all things. He is One, with no partners, Perfect in all characteristics and none is comparable to Him. He is the First without Beginning and the Last without End, the Eternal. He is Glorified beyond any similarity to any of His creations. He is Self-Subsisting and the Maintainer of all Creation.

Prophet Muhammad (peace be upon him): He is a Servant and the Last Messenger of Allah. He was born in Makkah in 570 A.D., received the Message of Islam at age 40 and died in 632 A.D. His life was well recorded in every aspect and detail, exemplary for all mankind, and he was known among his people as the truthful and trusted even before receiving the Message.

The Qur'an: The last and complete Revelation from Allah (God) to His Prophet Muhammad (peace be upon him), as a Guidance for all mankind. It is literally God's Word, faithfully memorized and recorded as it was revealed to the Prophet (peace be upon him), and it has been kept, absolutely unchanged, through the centuries.

Maybe it is important to emphasize the fact that the Qur'an is the only revealed Book which has been kept in its original language.

Hadith (Sunnah): The deeds, words, and approvals, both explicit and implicit, of Prophet Muhammad (peace be upon Him) which have been collected and narrated through accepted and known channels according to specific rules of criticism which apply to the conditions, situations and characters of the narrators. Maybe it is useful here to mention that this type of discipline, which was established by the Muslim scholars, is unique for recognizing the credibility and authenticity of reports and narrations from various sources.

III. Supporting evidence for the Messengers.

Allah (Glory be to Him) created humanity to recognize and worship Him through the submission and obedience of His orders and commands, in order that we can gain success in this life and happiness in the Hereafter. He selected a group of the ideal, righteous people for receiving and conveying His Message. He supported them for their proclamations of Prophethood with specific evidence and proofs, which are known as signs or miracles. Examples are the stick of Moses which turned into a snake, and the healing of the sick and the raising of the dead by Jesus, through the command of God.

It is noticeable that the nature of the miracles was compatible with the type and level of knowledge of the age and the interests of the society. Reasons for this compatibility could be as follows:

1. To affect the society in an area attracting the most attention and general emphasis.
2. For the arguments of the Prophets to triumph over the objections of the leaders and influential people of the society.
3. Testimony to the miraculous nature of the signs by the most knowledgeable scholars in the society, such that the society cannot claim a deficiency in its ability to judge the credibility of the Message.

IV. The significance of the signs.

The importance of the signs can be described as follows:

1. Since the Message itself is considered an abnormal phenomenon as an interactive communication between man and God, when it is accompanied by a sign or miracle, the people can recognize its truth. The sign is considered abnormal but can be observed as evidence, thereby making the claim of Prophethood credible.
2. A Prophet is a human being with human capabilities controlled by the laws of the universe, but he carries a sign which breaks the normal laws, reflecting the support and confirmation of God for his claim, since only the Creator, Who is over the universe and beyond its physical controls, is able to break these laws.
3. The miracles reflect the mercy of God for his servants and consideration for the rationalism of their thinking, through providing a measure whereby the true Prophets can be distinguished from the false. The implicit message is that people are instructed to avoid following a faith blindly.

V. Characteristics of the last Message.

The Message of Islam is complete, perfect and the Seal of the Messages, as the Qur'an mentions:

«الْيَوْمَ أَكْمَلْتُ لَكُمْ دِينَكُمْ، وَأَتَمَمْتُ عَلَيْكُمْ نِعْمَتِي، وَرَضِيتُ لَكُمُ الْإِسْلَامَ دِينًا»
(سُورَةُ الْمَائِدَةِ: آيَةُ ٣)

"This day have I perfected your religion for you, completed My favor upon you, and have chosen for you Islam as your religion." (Surah Al-Ma'ida, 5: Ayah 4) It has three main characteristics:

1. The continuation: It is a Message to apply through all the ages until the Day of Judgment.
2. Universality: It is a speech from God as a Guidance and Light for all humanity, both as individuals and as societies.
3. Comprehensiveness: It is an all-encompassing guidance for all ages in all different aspects of life — religious, social, political,

and economical — in a harmonious integration.

The occurrence of these characteristics in one Message means that the Qur'an, the Book of the Message, is itself a miracle and sign of Islam. The Prophet (peace be upon him) stated that the Qur'an, or Revelation, was the sign bestowed upon him:

قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ: "مَا مِنَ الْأَنْبِيَاءِ نَبِيٍّ إِلَّا أُعْطِيَ مِنَ الْآيَاتِ مَا مِثْلُهُ آمَنَ عَلَيْهِ الْبَشَرُ، وَإِنَّمَا كَانَ الَّذِي أُوتِيَتْهُ وَحْيًا أَوْحَاهُ اللَّهُ إِلَى فَارْجُو أَنْ أَكُونَ أَكْثَرَهُمْ تَابِعًا يَوْمَ الْقِيَامَةِ". (رَوَاهُ الْبُخَارِيُّ: فَتَحُ الْبَارِي ١٢/١ - وَرَوَاهُ مُسْلِمٌ فِي كِتَابِ الْإِيمَانِ)

"There has never been a Prophet amongst the prophets who was not bestowed with a sign amongst the signs which were bestowed (on the earlier prophets). Human beings became believers through them, and verily what I have been bestowed was a Revelation which Allah revealed to me. I hope that I will have the most followers on the Day of Resurrection." (related by Al-Bukhari and Muslim)

And, God (Glory be to Him) mentioned that the greatest miracle for Prophet Muhammad (peace be upon him) is the Qur'an:

"وَمَا كُنْتَ تَتْلُو مِنْ قَبْلِهِ مِنْ كِتَابٍ وَلَا تَخُطُّهُ بِيَمِينِكَ إِذَا لَارْتَابَ الْمُبْطِلُونَ، بَلْ هُوَ آيَاتٌ بَيِّنَاتٌ فِي صُدُورِ الَّذِينَ أُوتُوا الْعِلْمَ وَمَا يَجْحَدُ بِآيَاتِنَا إِلَّا الظَّالِمُونَ، وَقَالُوا لَوْلَا أَنْزَلَ عَلَيْهِ آيَاتٌ مِنْ رَبِّهِ قُلْ إِنَّمَا الْآيَاتُ عِنْدَ اللَّهِ وَإِنَّمَا أَنَا نَذِيرٌ مُبِينٌ، أَوَلَمْ يَكْفِهِمْ أَنَّا أَنْزَلْنَا عَلَيْكَ الْكِتَابَ يُتْلَى عَلَيْهِمْ إِنَّ فِي ذَلِكَ لَرَحْمَةً وَذِكْرَى لِقَوْمٍ يُؤْمِنُونَ، قُلْ كَفَى بِاللَّهِ بَيْنِي وَبَيْنَكُمْ شَهِيدًا يَعْلَمُ مَا فِي السَّمَاوَاتِ وَالْأَرْضِ وَالَّذِينَ آمَنُوا بِالْبَاطِلِ وَكَفَرُوا بِاللَّهِ أُولَئِكَ هُمُ الْخَاسِرُونَ". (سُورَةُ الْعَنْكَبُوتِ: آيَات ٤٨-٥٢)

"And you were not able to recite a Book before this (Book came), nor are you (able) to transcribe it with your right hand; in that case, indeed, would the talkers of vanities have doubted. Nay, here are Signs self-evident in the hearts of those endowed with knowledge, and none but the unjust reject Our Signs. Yet they say: 'Why are not Signs

sent down to him from his Lord?’ Say: ‘The Signs are indeed with God; and I am indeed a clear Warner.’ And is it not enough for them that We have sent down to you the Book which is rehearsed to them? Verily, in it is Mercy and a Reminder to those who believe. Say: ‘Enough is God for a Witness between me and you: He knows what is in the heavens and on earth. And it is those who believe in vanities and reject God, who will be the losers.’” (Surah Al-‘Ankabut, 29: Ayat 48-52).

Since the Qur’an is a continuous message and sign or miracle, as advances are made in any field of knowledge, the Qur’an will become manifest as a miracle with regard to that field. As an example, during the time of the Revelation, the Arabs were very talented in Arabic literature and poetry, and often held competitions in poetry, thereby raising the language to a very high standard. However, when they heard the Qur’an, they were astonished at the eloquence and expressiveness of its language to the extent that some described its effect upon the people as a magical influence. Since their skill in language was highly developed, the linguistic aspect of the Qur’an was the main proof of its Divine Source.

Today is the age of science. Many advancements have been achieved at a rapid pace, and science is respected over any other field as a search for truth. However, the Qur’an, through its continuously miraculous nature, is now proving with its unprecedented knowledge in scientific matters that it is truly the Words of the Creator, and nothing is hidden from His Knowledge.

In the interest of science, the issue is raised as to whether any of the scientific knowledge or religious heritage of the past provided correct scientific information. Fragments of ancient knowledge exist from the past, but based upon our modern discoveries, some of it is correct, and much of it is incorrect and mixed with superstitions. Even our modern knowledge is likely to be found in error in many ways in

the future, after further accumulation of data and greater development of scientific instrumentation. Therefore, it is extremely amazing to find an ancient text correctly referring to areas such as the stages of human development, the origin, present status, and future of the universe, and the classification of rain clouds, and furthermore, this text is free from any error.

In addition to the main miraculous aspect which is compatible with the knowledge of each particular age, the entire construction of the Qur'an, as a solution for all difficulties in all aspects of human existence, has continued as a unique guidance, proving its Source is beyond human capacity.

VI. Results of the Qur'anic miracle.

The main results for this phenomenon are indicated as follows:

1. The sign or miracle is compatible with the developing knowledge of humanity and accompanies the progress of advancement.
2. The message can be implemented in real life at an ideal, practical level. The constant and flexible needs and aspects of life are ideally distinguished, according to the different ages and locations of societies.
3. The Qur'an refers to many fields, and it is with ease that individuals of various backgrounds can understand its arguments and evaluate its credibility.
4. Other religions have deviated from their original messages and have been influenced by human thoughts and desires. As a result, many people have considered religions to be false accounts and superstitions. Therefore, the Qur'an carries strong evidence to counter these negative suspicions.
5. The Qur'an emphasizes its accuracy and purity from any mistakes, distinguishing it from any human production. It raises a challenge to any who dispute regarding its Message to produce a similar book, or ten chapters, or even one chapter comparable to

it. The Qur'an gives the result of this challenge in the following passage:

«قُلْ لِّئِنْ اجْتَمَعَتِ الْإِنْسُ وَالْجِنُّ عَلَىٰ أَنْ يَأْتُوا بِمِثْلِ هَٰذَا الْقُرْآنِ لَا يَأْتُونَ بِمِثْلِهِ وَلَوْ كَانَ بَعْضُهُمْ لِبَعْضٍ ظَهِيرًا» (سُورَةُ الْإِسْرَاءِ: آيَةُ ٨٨)

"Say: Verily, though mankind and Jinn should assemble to produce the like of this Qur'an, they could not produce the like thereof though they were helpers of one another." (Surah Al-Isra', 17: Ayah 88). Fourteen hundred years have passed since this challenge was issued and the nonproductive result emphasizes the Qur'an's position and its Great Source.

6. The Qur'an provides many facts regarding the physical world, corrects mistaken ideas, and attracts attention towards new areas of research, as will be shown in the following presentation by Dr. Moore.
7. Although the Qur'an and Hadith include much information in scientific areas, the overall nature of the Qur'an is to provide guidance and instruction to humanity. As the following passages mention:

«قَدْ جَاءَكُمْ مِنَ اللَّهِ نُورٌ وَكِتَابٌ مُبِينٌ، يَهْدِي بِهِ اللَّهُ مَنِ اتَّبَعَ رِضْوَانَهُ سُبُلَ السَّلَامِ وَيُخْرِجُهُم مِنَ الظُّلُمَاتِ إِلَى النُّورِ بِإِذْنِهِ وَيَهْدِيهِمْ إِلَى صِرَاطٍ مُسْتَقِيمٍ» (سُورَةُ الْمَائِدَةِ: آيَتَا ١٥-١٦)

"Now has come unto you Light from Allah and a clear and articulate Book, whereby Allah guides him who seeks His good pleasure into paths of peace and safety. He leads them out of darkness into Light by His decree, and guides them to a Straight Path." (Surah Al-Ma'ida, 5: Ayat 15-16)

«إِنَّ هَٰذَا الْقُرْآنَ يَهْدِي لِلَّتِي هِيَ أَقْوَمُ وَيُبَشِّرُ الْمُؤْمِنِينَ الَّذِينَ يَعْمَلُونَ الصَّالِحَاتِ أَنَّ لَهُمْ أَجْرًا كَبِيرًا» (سُورَةُ الْإِسْرَاءِ: آيَةُ ٩)

"Verily this Qur'an does guide to that which is most right (or

stable), and gives the glad tidings to the believers who work deeds of righteousness, that they shall have a magnificent reward." (Surah Al-Isra', 17: Ayah 9) Details in social and theological areas are given, since it is beyond human capacity to develop these areas ideally without conflict, while most details regarding the physical world are left to human discovery, since mankind's capacity is qualified for study in these areas.

8. Islam encourages mankind to seek knowledge and advance in our discoveries, promising us a great reward, and these efforts are considered part of the worship of God, since they are made with the intention of obedience to Him. This encouragement resulted in the establishment of a very great Islamic civilization in an amazingly short amount of time. It remained for many centuries until Europe, building upon the Islamic accomplishments, made further advancements in the areas of science and technology.

VII. Islamic achievements.

During a meeting with a professor in astronomy at the University of Illinois at Champaign, I mentioned how the Qur'an speaks about very advanced topics in different scientific fields, such as embryology, physiology, astronomy, geology and meteorology, and that even though the age of the Qur'an is now about 1400 years, modern scientific knowledge is agreeing with its words. His expression was of wonderment, and then he attempted to interpret this phenomenon by saying, "It is, of course, amazing, but I am aware that the Arabs made many great advancements in these fields, and they were leaders in the Middle Ages. Until today, we are using Arabic names for the stars."

I replied in agreement that what he had mentioned was true, but that the subject needed some detail and clarification, since the Arabs during the time of the revelation of the Qur'an were mainly illiterate and backwards among the civilizations. Other civilizations, such as

the Roman and Persian, were advanced at that time.

It is true that the teachings of the Qur'an and the Sunnah of the Prophet (peace be upon him) have inspired the Muslims, both Arabic and non-Arabic, to achieve rapid progress in the scientific field. As examples, are the fields of mathematics, since they invented algebra, which is still used with the same Arabic name in the English language, and the Arabic numerals were transferred to Western writing and still in use today. Before any other people, the Muslims attempted to measure the height of the atmosphere in order to determine the first light of dawn, since this knowledge would have significance for Islamic religious practices. The first scientist to attempt this measurement was Ibn Mu'adh in the 11th century. In the field of anatomy, Ibn An-Nafees was the first to describe the blood circulation. In the 12th century, in the field of astronomy, and by using advanced mathematics, Sanad Ibn Ali proved that the earth is smaller than the sun and bigger than the moon.

There is no doubt that the Qur'an has corrected some of the scientific misconceptions which were dominant at that time. For example, in the 11th century, the Muslim scholar, Ibn Hazm mentioned that the earth is round according to indications in the Qur'anic passages. Also, in the 14th century, Ibn Hajar (773-852 AH; 14th century AD) stated:

"The anatomists claim that the fetus is created from the menstrual blood of the woman, but the Islamic passages [Qur'an and Hadith] reject and refute their ideas." (Ibn Hajar Al-'Asqalani, *Fath Al-Bari*)

Therefore, the Islamic achievements in the scientific fields were the result of the Qur'anic teachings. The Qur'an preceded the Islamic civilization and was not a production of it. Additionally, Muslims began to lose their leadership in the scientific fields after they became distant from the Qur'anic teachings, and as a result, their societies began to degenerate and their motivation declined. This situation is

in contrast to the situation in Europe, where scientific progress developed after a rebellion against religious doctrine which was threatened by its contradiction with scientific discoveries.

VIII. Confirmation of the Qur'an.

Allah (Glory be to Him) emphasizes in the Qur'an that human discoveries and scientific development are praised in Islam and are considered as evidence of the Truth of the Qur'an. The following passage mentions:

«سَنُرِيهِمْ آيَاتَنَا فِي الْأَفَاقِ وَفِي أَنْفُسِهِمْ حَتَّىٰ يَتَبَيَّنَ لَهُمْ أَنَّهُ الْحَقُّ، أَوَلَمْ يَكُنْ بِرَبِّكَ أَنْتَهُ عَلَىٰ كُلِّ شَيْءٍ شَهِيدًا؟» (سُورَةُ فَصَّلَتْ: آيَةُ ٥٢)

"Soon We will show them Our signs in the farthest regions of the heavens and earth until it becomes manifest to them that it is the Truth. Is it not sufficient for them that your Lord does witness all things?"

(Surah Fussilat, 41: Ayah 53)

Another passage says:

«وَقُلِ الْحَمْدُ لِلَّهِ سِيرِكُمْ آيَاتِهِ فَتَعْرِفُونَهَا، وَمَا رَبُّكَ بِغَافِلٍ عَمَّا تَعْمَلُونَ» (سُورَةُ النَّحْلِ: آيَةُ ١٢)

"And say: 'Praise be to God, Who will soon show you His Signs, so that you shall know them'; and your Lord is not unmindful of all that you do." (Surah An-Naml, 27: Ayah 93)

God described the impression and reaction of scholars and of those who have knowledge as the first people who are going to recognize the facts and bear witness for the Source of the Qur'an and that it is a Guidance for the straight path. The Qur'an says:

«وَيَرَى الَّذِينَ أُتُوا الْعِلْمَ الَّذِي أُنْزِلَ إِلَيْكَ مِنْ رَبِّكَ هُوَ الْحَقُّ وَيَهْدِي إِلَى صِرَاطٍ الْعَزِيزِ الْحَمِيدِ» (سُورَةُ سَبَأًا: آيَةُ ٦)

"And those who have been given knowledge realize that the Revelation sent to you from your Lord is the Truth and that it guides to the Path of the Exalted in Might, Worthy of all praise." (Surah Saba', 34: Ayah 6)

The following presentation by Dr. Keith Moore provides evidence for the truth of these passages.

Acknowledgments

And I would just like to express my appreciation to the scientists from U.S.A., Canada, Britain and Australia, who have generously offered their time and efforts in our investigations in the areas of their specialities. In the field of embryology, there are Drs. Keith L. Moore, E. Marshall Johnson, T.V.N. Persaud, Gerald C. Goeringer and Joe Leigh Simpson. In the field of parasitology, Dr. George S. Nelson. In the field of geology, Drs. Allison R. Palmer, Robert G. Coleman and Don W. Steeples. In the field of astronomy, Drs. Ian D.R. Mackinnon and Walter Orr Roberts (deceased, March 1990). In the field of oceanography, Dr. William W. Hay. And, in the field of meteorology, Drs. Peter H. Hildebrand and G. Brant Foote. They approached the subjects objectively and expressed their view of high respect for the Qur'an and Sunnah.

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Finally, I would like to thank the Muslim Students Association and the University of Illinois for the arrangements for this symposium.

"وَأَخْرُ دَعْوَانَا إِنِ الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ" And, the conclusion of our speech is Praise be to Allah, Sustainer of the Worlds.



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HUMAN DEVELOPMENT IN THE QUR'AN, SUNNAH AND MODERN SCIENCE

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I. Historical background.

The first scientific studies in embryology known to us were made by the Greeks, beginning in the 5th century B.C. Hippocrates, "the Father of Medicine", and later, Aristotle examined chick embryos and concluded that man's development was similar to that of the chicken. The early part of the historical record are dominated by the writings of Aristotle and Galen, and from the time of Galen (circa 200 A.D.) until the 16th century, no major advances in our knowledge of embryology were recorded in the literature of Western science. Consequently, as far as we know, until the revelations in the Qur'an, man was relatively ignorant about his reproduction and development.

It was not until the invention of the microscope (Figure 1) in the 17th century that any significant new information was added to the embryological knowledge. Previously, and until the 16th century, the embryo was said to develop from a coagulum (clot) of blood and seed, which was a misconception of Aristotle carried down through the centuries. Menstrual blood was commonly thought to give rise to the embryo, and then spermatozoa or sperms were discovered with the microscope. However, these discoveries were associated with a great deal of imaginative thinking, and in 1694, the spermatozoan was said

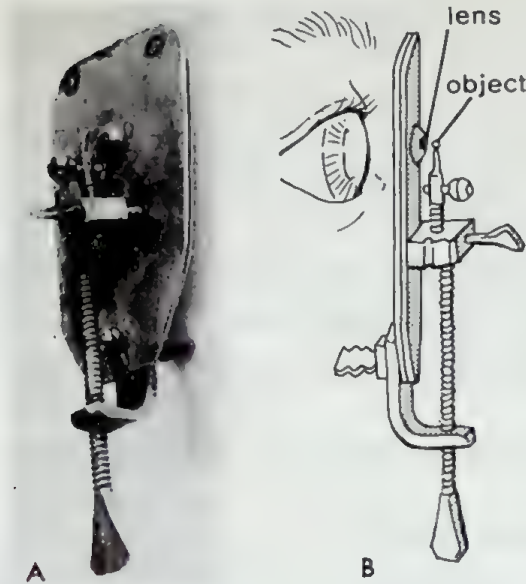


Figure 1. A, photograph of a Leeuwenhoek microscope (1673). B, lateral view of illustration of its use. The object under examination was held in front of the lens on the point of the short rod, while the screw arrangement was used to adjust the object under the lens. (Reproduced with permission from Moore, K.L., *The Developing Human, Clinically Oriented Embryology*, 4th ed., Philadelphia, 1988)

to contain a miniature human being, or homunculus (Figure 2)! According to this result, the female contribution to human development was minimized. The fact that the sperm and ovum were necessary for conception was not known until the 18th century. It was not until later refinements were made in the optical qualities of microscopes and more controls were exerted over experimental methods, that the very earliest aspects of embryological growth could be recorded.

II. Concept of stages. Later developments in embryology involved the concept of stages, and the first attempts to arrange human embryos in stages were made towards the end of the 19th century. These efforts continued during the early part of the 20th century. In 1914, Mall arranged 266 human embryos in a series of stages. Twenty-eight years later, Streeter classified human embryos in 23 stages which he

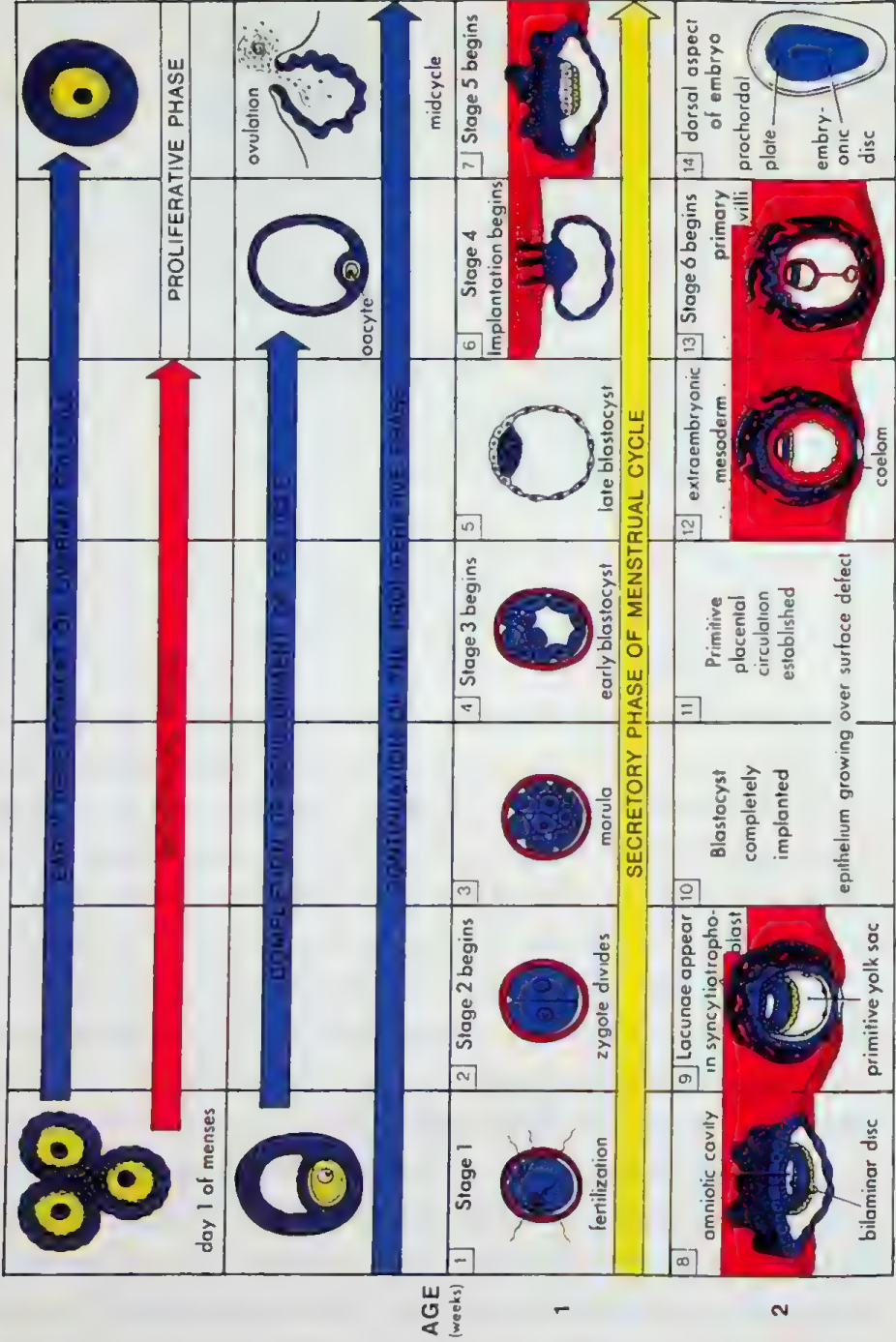


Figure 2. Hartsoeker's drawing of a human spermatozoon containing a homunculus (from his *Essay de Dioptrique*, 1694). (Reprinted with permission from Meyer, 1939)



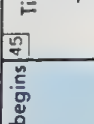
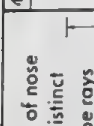
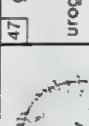
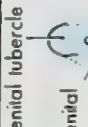

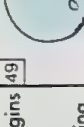
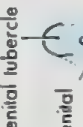
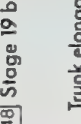

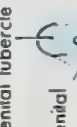
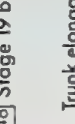

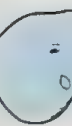


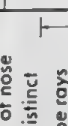
called developmental horizons. Streeter's classification was used worldwide until 1973, when O'Rahilly developed a more detailed system for classifying human embryos, particularly during the first three weeks of development. These Carnegie stages have received international approval and are based on various developmental events and morphological criteria (Figure 3).

A major difficulty in the classification terminology is the fact that the shape of the embryo is continuously changing. The principles for nomenclature and terminology for descriptive embryology are that the terms applied to a particular development should be descriptive of what the embryo really looks like. There should also be full agreement between the term and the nature of the development, events occurring in the embryo at that stage. In order to avoid confusion, each term should define a stage which has a clear beginning and end as is possible to avoid any overlap between stages, or on the other

Figure 3. TIMETABLE OF HUMAN PRENATAL DEVELOPMENT
1 to 38 weeks



15	first missed menstrual period	16	Stage 7 begins noto- chordal process	17	intra- embryonic mesoderm	18	Stage 8 begins neural plate primitive streak	19	neural fold notochord embryonic coelom	20	Stage 9 begins brain neural groove somite Thyroid begins to develop.	21	neural groove somite Heart tubes begin to fuse.
22	Stage 10 begins Heart begins to beat Neural folds fusing.	23	rostral neuropore primordia of eye and ear present. caudal neuropore	24	Stage 11 begins heart bulge rostral neuropore closes 2 pairs of branchial arches	25	otic pit 3 pairs of branchial arches	26	Stage 12 begins arm bud indicates actual size	27	4 pairs of branchial arches, arm & leg buds present CR = crown- rump length	28	Stage 13 begins CR: 4.0 mm
29	CR: 5.0 mm	30	Lens pits, optic cups, nasal pits forming.	31	developing eye nasal pit primitive mouth	32	Stage 14 Hand plates (paddle-shaped) Lens pits and optic cups formed	33	Stage 15 begins hand plate CR: 7.0 mm	34	Head much larger relative to trunk. cerebral vesicles distinct leg buds (paddle-shaped)	35	CR: 8.0 mm
36	CR: 9.0 mm	37	Stage 16 begins fool's plate CR: 9.0 mm	38	Upper lip formed.	39	CR: 10.0 mm	40	Arms bent at elbow. Finger rays and auricular hillocks distinct Palate developing.	41	Stage 17 begins finger rays ventral view	42	CR: 13.0 mm

AGE (weeks)	7				8				9				10															
43	 CR: 16.0 mm.	 Stage 18 begins	 Tip of nose distinct Toe rays appear Ossification may begin CR: 17.0 mm	 Loss of villi Smooth chorion forms.	47  urogenital membrane anal membrane ♀ or ♂	48 Trunk elongating and straightening	49  CR: 18 mm	50 Upper limbs longer & bent at elbows Fingers distinct	51  Anal membrane perforated Urogenital membrane degenerating Testes and ovaries distinguishable	52 Stage 21 begins CR: 17.0 mm 	53 Stage 21 External genitalia still in sexless state but have begun to differentiate.	54 Stage 22 begins CR: 18 mm  genital tubercle urethral groove anus ♀ or ♂	55 Stage 23 CR: 30 mm Beginnings of all essential external & internal structures are present.	56  CR: 30 mm	57 beginning of fetal period	58 	59 Stage 24 CR: 30 mm Genitalia show some ♀ characteristics but still easily confused with ♂.	60  phallus urogenital fold labioscrotal fold perineum ♀	61 Stage 25 CR: 50 mm Genitalia show fusion of urethral folds. Urethral groove extends into phallus.	62  phallus urogenital fold labioscrotal fold perineum ♂	63  CR: 50 mm	64 Face has human profile Note growth of chin compared to day 44.	65 	66 Stage 26 CR: 61 mm Face has human appearance.	67  clitoris labium minus urogenital groove labium majus ♀	68 Stage 27 CR: 61 mm Genitalia have ♀ or ♂ characteristics but still not fully formed	69  glans penis urethral groove scrotum ♂	70  CR: 61 mm

The Nash'ah Stage (Fetal Period)

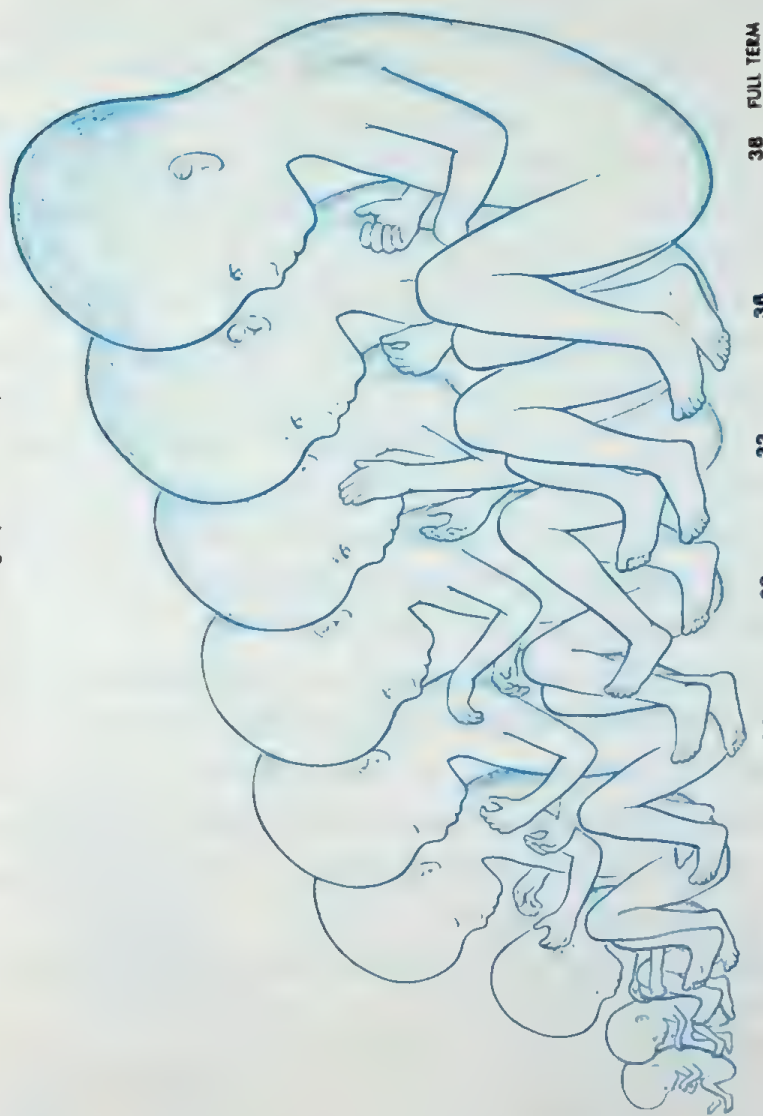


Figure 3. Development begins at fertilization, about 14 days after the onset of the last menstruation. The nutfah stage, involving cleavage of the zygote in the uterine tube and implantation of the blastocyst, and the khalq stage, involving early development of the embryo until the eighth week, are shown. Development in the fetal or nash'ah stage is shown in weeks 9 and 10. (Reproduced with permission from Moore, Keith L., *The Developing Human, Clinically Oriented Embryology*, 4th edition, Philadelphia, 1988)

hand, to avoid any gaps between one stage and another.

III. Qur'anic terminology. Until recently it was not known that the Qur'an, the holy book of the Muslims, and the Sunnah, or Hadith, the teachings of Muhammad (peace be upon him), contain many citations referring to the stages of human development. Until recently these statements were not clearly understood, since they referred to details in development which were scientifically unknown in earlier times.

In fact the Islamic system for classifying embryos is amazing since it was recorded in the 7th century A.D. Although Aristotle, the founder of the science of embryology, realized that chick embryos developed in stages from his study of hens eggs in the 4th century B.C., he did not give any details about these stages. Also, the early human embryo is of such a minute size that detailed studies would have been impossible without the microscope. As far as is known from the history of embryology, little was known about the staging and classification of human embryos until the last 100 years, as was just mentioned. Moreover, the Qur'anic terminology fulfills the principles for nomenclature and terminology.

For this reason, the descriptions of the human embryos in the Qur'an cannot be based on any scientific knowledge in the 7th century. The only reasonable conclusion is that these descriptions were revealed to Muhammad (peace be upon him) by God. He could not have known such details because he was an illiterate man with absolutely no scientific training.

The following passage from the Qur'an introduces the concept of stages in human development :

”يَخْلُقُكُمْ فِي بُطُونِ أُمَّهَاتِكُمْ خَلْقًا مِّنْ بَعْدِ خَلْقٍ فِي ظُلُمَاتٍ ثَلَاثٍ“ (سُورَةُ الزُّمَرُ ٢١: آيَةُ ٦)

“God makes you in the wombs of your mothers in stages, one after another, within three veils of darkness” (Surah Az-Zumar, 39: Ayah 6). The embryo develops in the mother's womb (uterus) protected by three veils or layers (Figure 4).

The Qur'an and Sunnah have classified the stages of human development as follows:

«وَلَقَدْ خَلَقْنَا الْإِنْسَانَ مِنْ سُلَالَةٍ مِنْ طِينٍ، ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَكِينٍ، ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ عِظَامًا فَكَسَوْنَا الْعِظَامَ لَحْمًا ثُمَّ أَنْشَأْنَاهُ خَلْقًا آخَرَ فَتَبَارَكَ اللَّهُ أَحْسَنُ الْخَالِقِينَ» (سُورَةُ الْمُؤْمِنُونَ: آيات ١٢-١٤)

"We (God) created man from a quintessence of clay. We then placed him as a nutfah (drop) in a place of settlement, firmly fixed, then We made the nutfah into an alaqah (leech-like structure) and then We changed the alaqah into a mudghah (chewed-like substance), then We made out of that mudghah, izam (skeleton, bones), then we clothed the skeleton with lahm (muscles, flesh), then We caused him to grow and come into being and attain the definitive (human) form. So, blessed be God, the best to create" (Surah Al-Mu'minoon, 23: Ayat 12-14). This passage describes three main stages: (1) the *nutfah*, or drop stage; (2) the shaping stage (*khalq*); and (3) the growth stage (*nash'ah*). These three stages are further subdivided in the passage and in other Islamic passages.

The *nutfah* stage involves the sperm and ovum and their union to

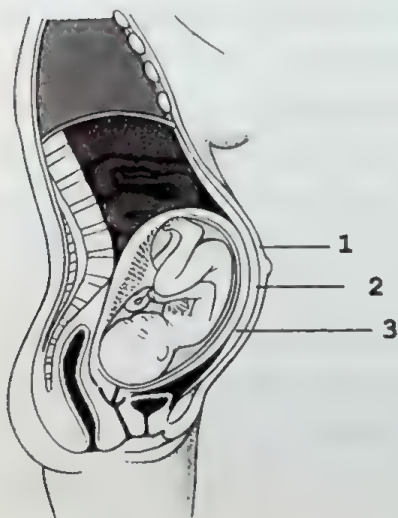


Figure 4. Section of woman at 30 weeks of pregnancy. The three veils of darkness are: 1 represents the anterior abdominal wall, 2 the uterine wall and 3 the amniochorionic membrane. (Modified and reproduced with permission from Moore, K.L., *Before We Are Born, Basic Embryology and Birth Defects*, 3rd ed., Philadelphia, 1989)

form the fertilized zygote, the cell division to form the blastocyst, and the implantation into the uterus. The shaping stage is further divided into the *alaqah*, *mudghah*, *izam* and *lahm* stages. During the latter part of this stage, the embryo also develops a human appearance and undergoes a straightening of its bodily form. The growth stage includes what is known as the fetal period and involves modifications in bodily proportions, the development of the individual appearance or features, and the growth and refinement of various organ systems.

IV. The nutfah stage. The nutfah means “a small amount of fluid or a drop of it”. As the first stage, called the nutfah, it includes five phases or substages, which involve the mixing of male and female germinal fluids, fertilization, implantation and early cell divisions.

A. Phases of the nutfah.

1. Al-ma'ad-dafiq (the gushing fluid; a drop emitted).

It is known that the male discharge gushes forth, as indicated in the following Qur'anic passage:

«فَلْيَنْظُرِ الْإِنْسَانُ مِمَّ خُلِقَ، خُلِقَ مِنْ مَّاءٍ دَافِقٍ» (سُورَةُ الطَّارِقِ : آيَتَا ٥، ٦)
 “Let man but think from what he is created! He is created from a drop emitted.” (Surah At-Tariq, 86: Ayat 5-6)

The grammatical analysis of the Arabic verb for “emitted” shows us that the meaning in the above Qur'anic statement is that the discharge is self-emitting, and thus, motile.

Modern science has now proven that in order for fertilization to occur, the spermatozoa must be motile and active (Figure 5). It has also been proven that the female discharge, which contains the ovum, is expelled to the fallopian tube and that it must be moving within it for fertilization to occur (Figure 6).

The fact that the semen contains prostaglandins which induce uterine contractions and may aid in the transport of sperm to the fertilization site is yet another aspect of motility.

Other components to the process involve important components

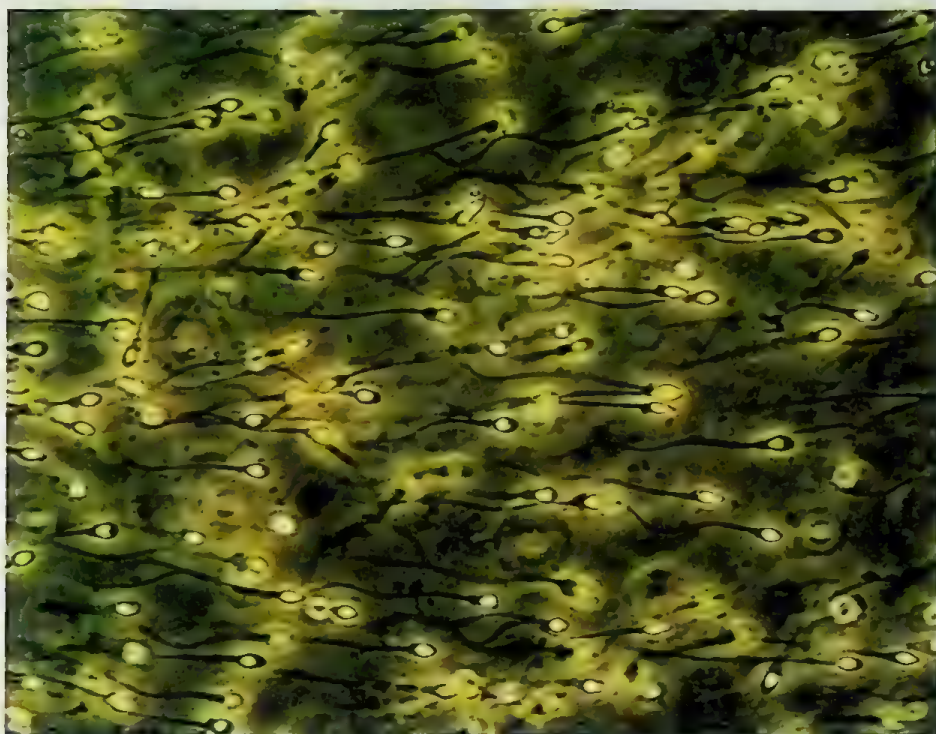


Figure 5. Sperm, magnified about 450 times. Each has an oval, slightly pointed head, short body and whiplash tail, which provides the motility that assists in the transport of the sperm to the fertilization site. (Reproduced with permission from Lennart Nilsson *et al*, *A Child is Born*, Dell Publishing Company, 1976)

of the female fluid. During the fertile phase of the woman's menstrual cycle, the cervical mucus, which is otherwise fairly impervious to sperm, becomes clear and gel-like through a realignment of its molecules and allows the sperm to pass. Enzymes secreted by the linings of the uterus (endometrium) and the oviducts remove glycoproteins from the head of the sperm and capacitate it. Unless they have been capacitated, sperm are unable to fertilize ova. In addition, enzymes secreted by the oviducts loosen the follicular cells surrounding the ovum, thereby exposing its protective membrane to the sperm.

The fact that the fluids of male and female are involved with fertilization was mentioned in the following hadith:



Figure 6. Unfertilized ovum in the folds of the oviduct and surrounded by follicular cells. The folded mucus membrane of the oviduct secretes enzymes which gradually loosen the outer envelope of cells and allow the sperm to reach the protective membrane of the ovum. (Reproduced with permission from Lennart Nilsson in *The Incredible Machine*, National Geographic Society)

ثُمَّ قَالَ: يَا مُحَمَّدُ مِمَّ يُخْلَقُ الْإِنْسَانُ ؟ فَقَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ:
يَا يَهُودِيُّ مِنْ كُلِّ يَخْلُقُ، مِنْ نُطْفَةِ الرَّجُلِ وَمِنْ نُطْفَةِ الْمَرَأَةِ. (رَوَاهُ أَحْمَدُ
فِي مُسْنَدِهِ)

"When the Prophet (peace be upon him) was asked by a Jewish person, 'O, Muhammad, what is man created from?' The Prophet answered, 'O, Jew, he is created from both: from the fluid of the man and the fluid of the woman'" (Musnad Ahmed). Thus the word nutfah used in the hadith is a very comprehensive term.

2. Sulalah.

Sulalah refers to the selection from the male and female fluids, as the following passages mention:

«مَا مِنْ كُلِّ الْمَاءِ يَكُونُ الْوَلَدُ...» (صَحِيحُ مُسْلِمٍ: كِتَابُ النِّكَاحِ، بَابُ الْعَزْلِ)
 "Not from all the fluid is the offspring created" (Sahih Muslim: Kitāb An-Nikah, Bab Al-Azl).

«ثُمَّ جَعَلَ نَسْلَهُ مِنْ سُلَالَةٍ مِنْ مَاءٍ مَهِينٍ» (سُورَةُ السَّجْدَةِ ٢٢: آيَةُ ٨)
 "Then He (God) made his (man's) progeny from a quintessence (sulalah) of a lowly fluid" (Surah As-Sajdah, 32: Ayah 8). Thus the creation from both fluids occurs through a special selection. The Qur'anic term for this selection is *sulalah*, which means in Arabic "gentle extraction from fluid". It is now known that both ovum and sperm are gently extracted from their fluid environments in the process of fertilization. The ovum is selected from a long stream of follicular fluid, while one sperm out of millions is selected from the seminal fluid. The first sperm which touches the cell membrane of the ovum enters easily, but immediately afterwards a rapid physical, chemical change occurs in the cell membrane, selecting that sperm only and all other sperm are locked out (Figure 7).

3. Nutfah amshaj.

The fertilized ovum, or zygote, takes the form of a drop or *nutfah amshaj* (drop of mingled fluid). As God says in the Qur'an:

«إِنَّا خَلَقْنَا الْإِنْسَانَ مِنْ نُطْفَةٍ أَمْشَاجٍ» (سُورَةُ الْاٰدٰهِرِ ٧٦: آيَةُ ٢)
 "We created man from a drop of mingled fluid (*nutfah amshaj*)" (Surah Ad-Dahr, 76: Ayah 2). An important point with regard to this phrase is the fact that "nutfah" is a singular noun while "amshaj" is a plural modifying adjective. According to conventional rules of grammar, singular nouns are normally modified by singular adjectives, and thus the term "nutfah amshaj" was a mystery to earlier Qur'anic scholars. However, this peculiarity in the language can now be explained, since we now know that the zygote remains singular as



Figure 7. Two electron microscope images. *Upper*, the sperm has just touched the surface of the ovum. *Lower*, the head of the sperm has entered the ovum. At this time the cell membrane of the ovum locks out all the other sperm. This process in the nutfah stages is known as sulalah, since one sperm and one ovum have now been selected to combine and initiate human development. After entering the cell, the tail and outer coat of the sperm dissolves and the genetic material will combine. (Reproduced with permission from Lennart Nilsson *et al*, *A Child is Born*, Dell Publishing Company, 1976)

a nutfah, while internally the chromosomes and other contributions from the sperm and ovum form a plural mixture described as amshaj. Therefore, from a scientific point of view, "amshaj" is entirely accurate as a plural adjective modifying the singular "nutfah", which is really a multifaceted single entity.

This stage continues its development, maintaining the shape of the nutfah, but dividing into smaller and smaller cells called blastomeres, until four days later it forms a spherical mass of cells known as a morula. Five days after fertilization the nutfah then forms a blastocyst as the morula's cells separate into two parts (Figure 8). During this time the term amshaj very appropriately applies to the nutfah in all of its developments, since it continues to be a multifaceted entity.

4. Taqdeer.

In the early formation of the nutfah amshaj, the chromosomes from both parents mix and form diploid pairs. This genetic mixture will determine the characteristics of the child as well as the child's sex. As the Qur'an mentions:

«مِنْ نُطْفَةٍ خَلَقَهُ فَقَدَرَهُ» (سُورَةُ عَبَسَ ٨٠ : آيَةُ ١٩)

"He created him from nutfah and immediately laid down the plan or program of his [future development] (faqaddarrah)" (Surah 'Abasa, 80: Ayah 19).

5. Harth.

In the last phase of nutfah amshaj, the blastocyst implants into the endometrium or uterine lining. This passage from the Qur'an states: «نِسَاؤُكُمْ حَرْثٌ لَكُمْ فَأْتُوا حَرْثَكُمْ أَنْتُمْ» (سُورَةُ الْبَقَرَةِ ٢ : آيَةُ ٢٢٢)
"Your wives are a tilth (harth) unto you, so approach your tilth when or how you will" (Surah Al-Baqarah, 2: Ayah 222). "Tilth" (*harth*) refers to cultivation of the soil.

The last step of the nutfah stage begins with the implantation of the blastocyst and is called the *harth* phase. The Qur'an considers this

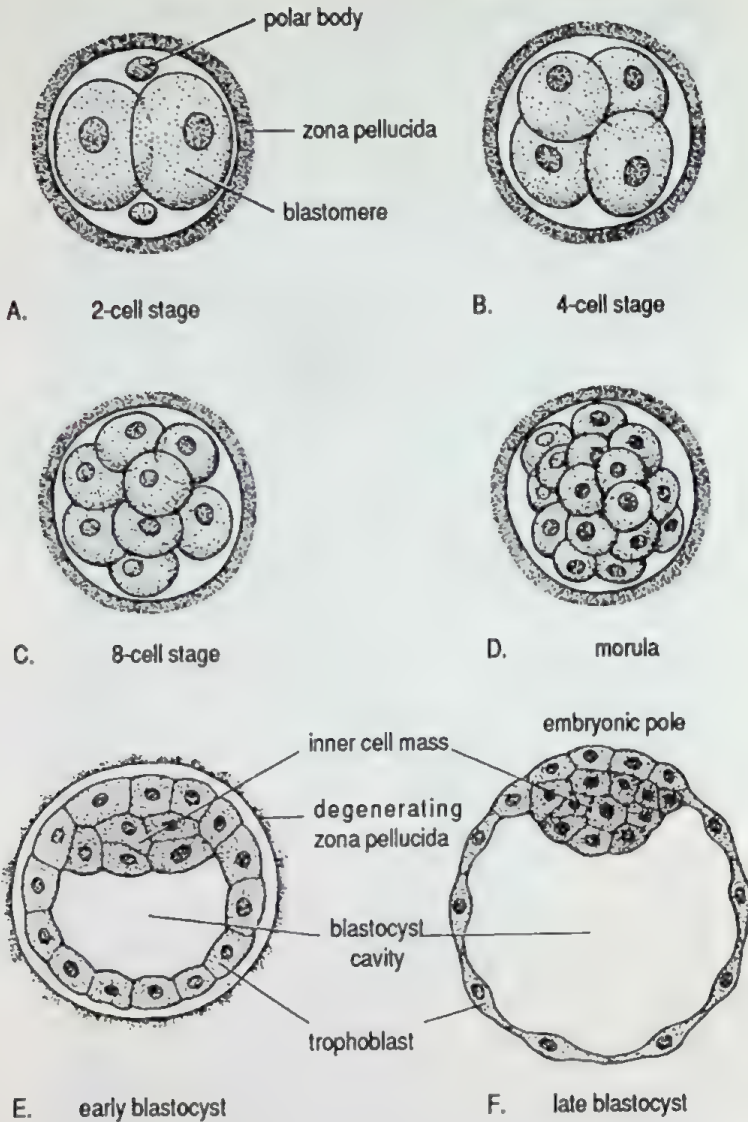


Figure 8. Cleavage of the zygote and formation of the blastocyst or *nutfah amshaj*. A to D show various stages of cleavage in developmental stage 2. The period of the morula begins at the 12- to 16-cell stage and ends when the blastocyst forms, which occurs when there are 50 to 60 blastomeres present. E to F are sections of blastocysts in developmental stage 3. The zona pellucida has disappeared by the late blastocyst stage at five days. The polar bodies shown in A are small, nonfunctional cells that soon degenerate. (Reproduced with permission from Moore, K.L., *The Developing Human, Clinically Oriented Embryology*, 4th ed., Philadelphia, 1988)

process analogous to the cultivation of the soil and the lining of the uterus like the soil in which a seed develops. Indeed, the blastocyst embeds ("roots") itself into the endometrium owing to substances released from cells which will eventually form the placenta, just as a seed embeds itself into the soil (Figure 9). Embryologists now use the term implantation in describing this event, and in Arabic "implantation" is translated as "al-ghars" which is very similar in meaning to "al-harth".

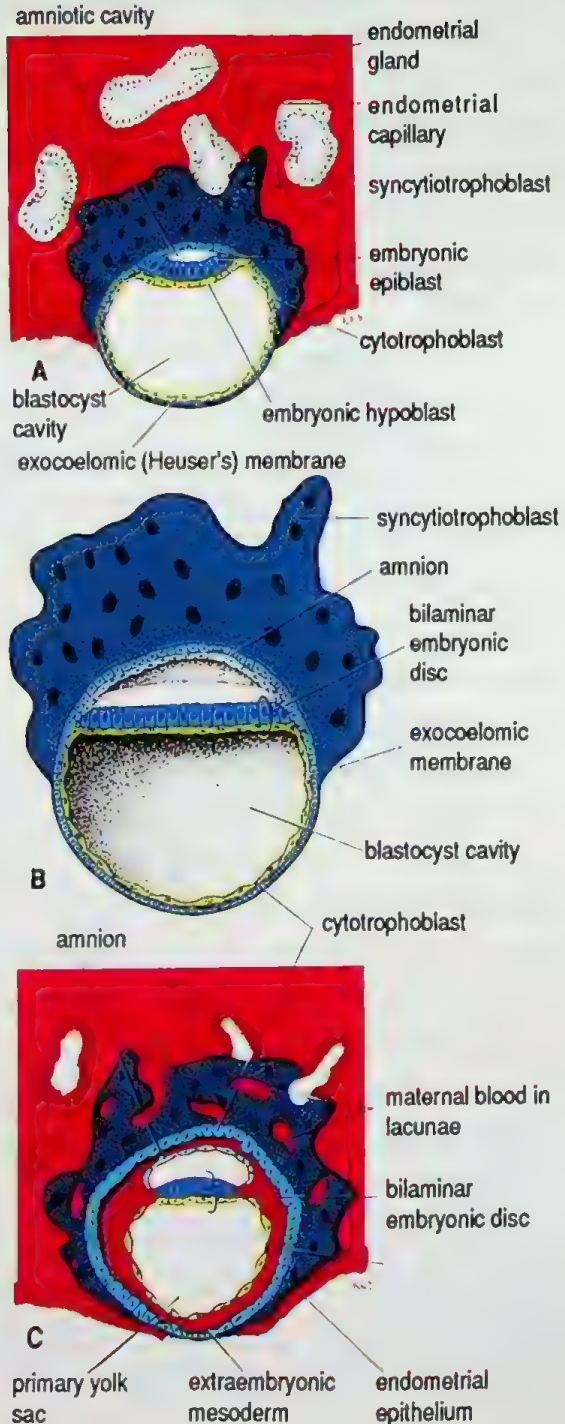
Thus the Qur'an has described all aspects of the nutfah stage from beginning to end, using scientifically accurate and descriptive terms for each phase (Figure 10). The developments and structural changes which occur during the nutfah stage are impossible to detect without a microscope due to the minute size of the nutfah (Figure 11).

V. The shaping (khalq) stage.

A. The alaqah stage. The second or shaping stage, begins as the alaqah, an Arabic word meaning "a leech". During the early shaping stage, the embryo loses its rounded shape and elongates until it takes the shape of a leech (Figure 12). The similarity between the embryo and a leech is truly amazing. The embryo is attached to the wall of the chorion - the chorionic sac - which has chorionic villi which are attached to the endometrium or lining of the uterus. The embryo is surrounded by amniotic fluid just as the leech is surrounded by water. Internally, the embryo acquires a primitive circulatory and nervous system during this stage. Thus the term, alaqah, refers to the leech-like external appearance of the embryo, as well as to its clinging relationship to the uterus, and is an appropriate descriptive term for this stage.

Another meaning mentioned by the interpreters for alaqah is "similar to a blood clot", and the external appearance of the embryo during this phase is similar to that of blood, due to the appearance of the primitive heart and cardiovascular system. The blood does not

Figure 9. Illustration of the implantation of a blastocyst into the endometrium during the harth phase. The actual size of the conceptus is about 0.1 mm. **A**, Section through a blastocyst partially implanted in the endometrium at about eight days. The amniotic cavity is slit-like. **B**, An enlarged view of a slightly older blastocyst after removal from the endometrium. The syncytiotrophoblast has become more extensive at the embryonic pole and the amniotic cavity has become much larger. **C**, Section through a blastocyst of about nine days implanted in the endometrium. Spaces or lacunae have appeared in the syncytiotrophoblast, and these soon communicate with the endometrial vessels. This type of implantation, in which the blastocyst becomes completely embedded in the endometrium, is known as interstitial implantation. (Reproduced with permission from Moore, K.L., *The Developing Human*, 4th ed., Philadelphia, Saunders, 1988)



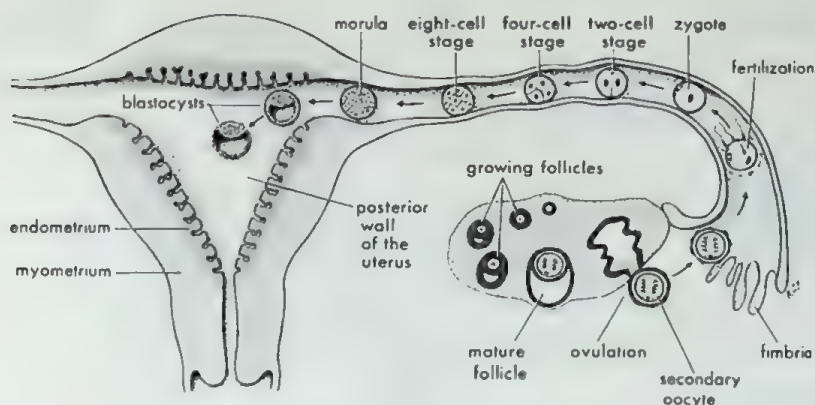


Figure 10. Diagrammatic summary of the nutfah stage during the first week of human development. The description, *sulalah*, applies to the selection at fertilization. The term *nutfah amshaj* applies to the time from the formation of the zygote (day 1) through the formation of the morula and early blastocyst (days 4 to 5). Harth refers to the implantation which begins at day 6. (Reproduced with permission from Moore, K.L., *The Developing Human*, 4th ed., Philadelphia, Saunders, 1988)

begin to circulate until the end of the third week (Figure 13), but on the twenty-first day, the heart of the embryo connects with the blood vessels in the embryo, the connecting stalk, the chorion and the yolk sac, and the blood starts to circulate. Thus the embryo takes the appearance of a blood clot even though its blood is fluid, and these features incorporate the other meaning of “a blood clot” for the *alaqah* phase.

B. The mudghah stage. The embryo at 24-25 days is finishing the *alaqah* stage. It changes into the *mudghah* stage at 26-27 days. Indeed, the transformation from *alaqah* to *mudghah* is very rapid, and during the last day or two of the *alaqah* stage, the embryo is beginning to develop some of the characteristics of the *mudghah*, e.g. the bead-like somites begin to appear (Figure 14).

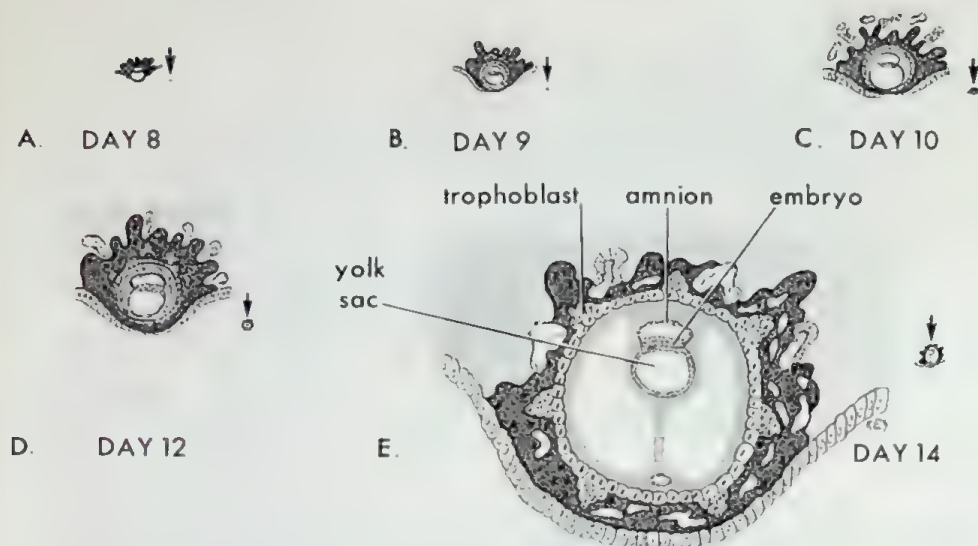


Figure 11. Drawings of human blastocysts during the hatching phase of the nutfah stage. The trophoblast expands rapidly during this period while the embryo has a relatively minute size (x 25). The arrows indicate sketches which show the actual size of the blastocysts at the gestational ages indicated. The detailed description given for the nutfah in the Qur'an and Hadith is amazing, considering the actual size involved as well as the gestational age, since the end of the nutfah stage (day 14) coincides with the time usually expected for menstruation, and it is not likely that a woman would know she is pregnant before this time. (Reproduced with permission from Moore, K.L., *The Developing Human*, 4th ed., Philadelphia, Saunders, 1988)

The word “*mudghah*” means a piece of substance which has been chewed, and as used to describe this next phase of embryonic development, it should apply with the shape of a substance that the teeth have chewed.

In fact, the appropriateness of the term *mudghah* has been indicated in modern embryology. It has been determined that after the formation of the embryo and the placenta at this stage, the embryo receives its nutrients and energy, thereby rapidly increasing the growth process. The bodily masses, called somites, from which the bones and muscle will form, start to appear. Due to the multitude of

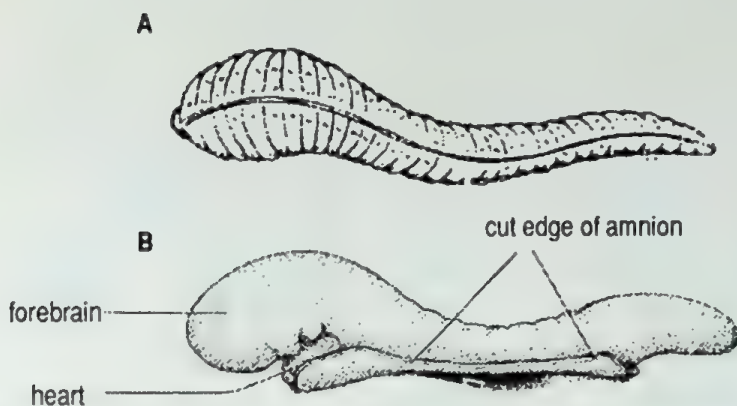


Figure 12. Drawings illustrating the similarities in appearance between a leech (alaqah) and a human embryo. A shows a leech. (Modified from Hickman, C.P. *et al*, *Integrated Principles of Zoology*, 6th edition, St. Louis, The C.V. Mosby Co., 1979) B shows a lateral view of an embryo at days 24 to 25 of the alaqa stage during folding, showing the large forebrain and the ventral position of the heart. (Reproduced with permission from Moore, K.L., *The Developing Human, Clinically Oriented Embryology*, 4th ed., Philadelphia, W.B. Saunders Co., 1988)

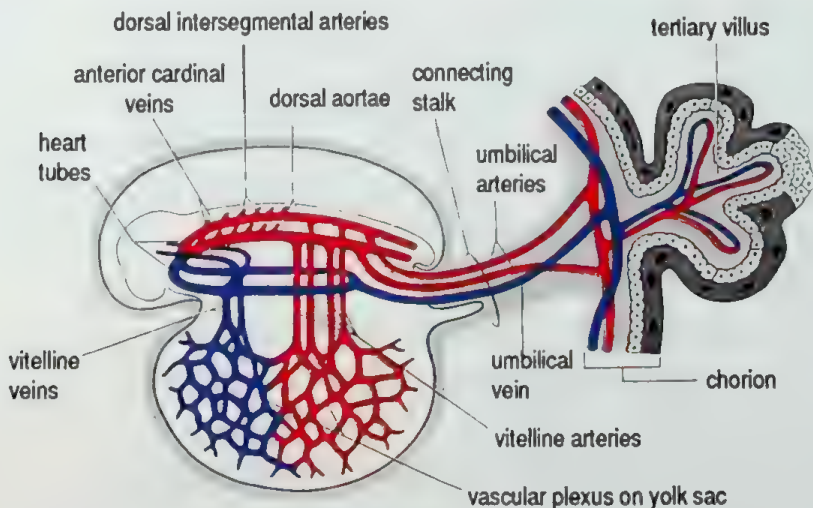


Figure 13. Diagram of the primitive cardiovascular system in an embryo during the alaqa stage (about 20 days). At this stage, the embryo is now dependent on the maternal blood for its nutrition. Due to the presence of large amounts of blood present in the embryo and the chorion, the description of alaqaah as a blood clot is clear. (Reproduced with permission from Moore, K.L., *The Developing Human, Clinically Oriented Embryology*, 4th ed., Philadelphia, W.B. Saunders Co., 1988)

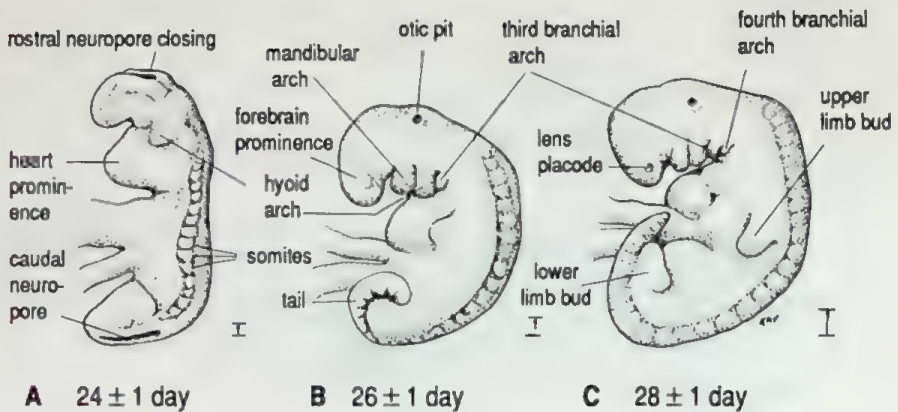


Figure 14. Drawings of embryos during the fourth week. A, B, and C, Lateral views of the embryos, showing 16, 27, and 33 somites respectively. A, The embryo in the last day of the alaqah stage. B and C, Embryos in the beginning of the mudghah stage. (Reproduced with permission from Moore, K.L., *The Developing Human, Clinically Oriented Embryology*, 4th ed., Philadelphia, W.B. Saunders Co., 1988)

bead-like structures or somites present, the embryo has the appearance of a substance that has been chewed and imprinted by the teeth. The processes of this period can be recognized in the following points:

1. The appearance of the somites or "imprints" changes continuously, just as teeth imprints change on a substance with each act of chewing. The embryo changes its overall shape, but the structures derived from the somites remain.
2. The embryo turns in its position due to modifications in its center of gravity as new tissues form, similar to the turning of a substance during chewing.
3. Just as a chewed substance becomes curled before being swallowed, so does the back of the embryo become curved.
4. As the somites form, the internal features of the embryo in the mudghah stage are partly differentiated into organ anlage and partly undifferentiated, and this description is also stated in the Qur'an:

ثُمَّ مِنْ مُضْفَةٍ مُخَلَّقَةٍ وَغَيْرِ مُخَلَّقَةٍ (سُورَةُ الْحَجِّ ٢٢: آيَةٌ ٥)
"Then out of a chewed-like substance partly differentiated and partly undifferentiated" Surah Al-Hajj, 22: Ayah 5).

Thus the term *mudghah* is very meaningful, since the embryo is a lump of irregularly shaped tissue at this stage, and the creation of systems is occurring while the overall process is incomplete. Some of the organs will form in the *mudghah* stage and some will form in later stages.

C. The *izam* stage. The subsequent phase of development is referred to as *izam* which means "bones", and the fetus does indeed acquire a cartilaginous skeleton of bones after the *mudghah* stage. Formation of bone does not begin uniformly throughout the body. Rather, there is a sequential appearance of bony tissue. In recent decades, the process of osteogenesis (bone formation) in the human embryo has been reasonably well documented. Bone development in the limbs commences in the embryonic limb buds from mesenchymal cells. Primary ossification centers appear in the femur during week 7 (Figure 15) and in the sternum (breast bone) and the maxilla (upper jaw) during weeks 8-9. The timing of the *izam* phase has been mentioned in the following hadith:

عَنْ حُذَيْفَةَ رَضِيَ اللَّهُ عَنْهُ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ: «إِذَا مَرَّ
 بالنطفة ثنتان وأربعون ليلة بعث الله إليها ملكاً فصورها وخلق سمعها وبصرها
 وجلدها ولحمها وعظامها...» (صحيح مسلم: كتاب القدر)

روى أبو عوانة هذا الحديث بإدراج لفظ "نطفة" بعد قوله "أربعين يوماً" أي أن روايته هي "إن
 أحدكم يجمع خلقه في بطن أمه أربعين يوماً نطفة" إلا أن هذه الرواية ضعيفة السند، كما أن هذا
 اللفظ المدرج لا أصل له في جميع روايات البخاري ومسلم، ولا في غيرهما من الروايات في كتب
 الأصول. (فتح الباري: ١١ / ٤٧٦ - ٤٨١)

This hadith was also narrated by Abu 'Awana, with the insertion of the word "nutfah" after "40 days." Accordingly, his version states: "In every one of you all components of your creation are collected together in your mother's womb by 40 days as nutfah." However, according to the measures of criticism for authenticity, the chain of narrators for this hadith is weak, and the inserted word does not occur in the versions from Al-Bukhari, Muslim, and other main books of hadith. (*Fath al-Bari*, vol. 11, pp 479-481)

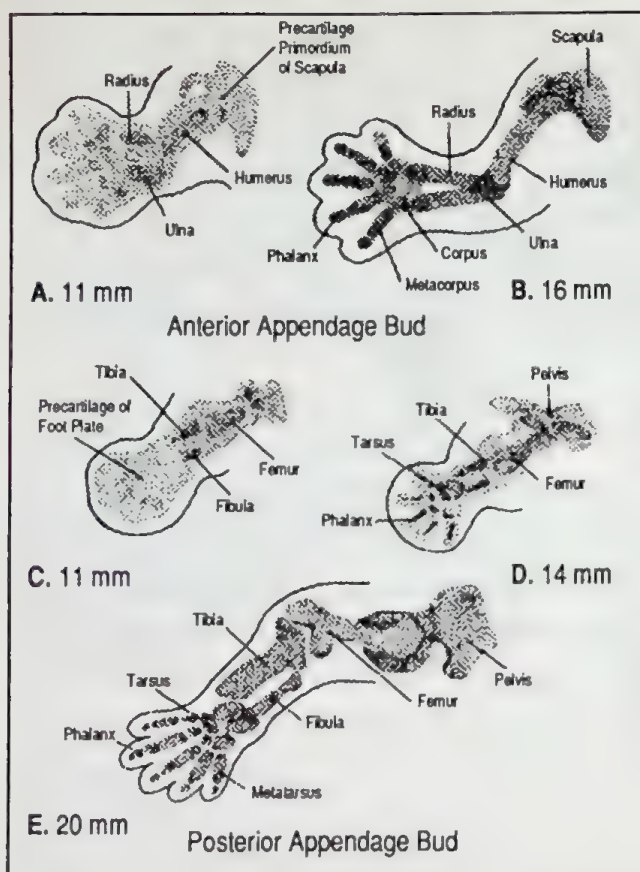


Figure 15. Primary ossification centers in the human embryo during the seventh week. (Reprinted with permission from Patten, 1968)

“When 42 nights have passed from the time of the nutfah (time of conception), Allah sends an angel to it, who shapes it and makes its ears, eyes, skin, muscles and bones....” (Sahih Muslim, Kitab Al-Qadar).

In the early part of this phase, the embryo takes on a human appearance (*tasweer adami*), and the hadith describes this with the word “shapes”. Before the 42nd day, it is difficult to distinguish the human embryo from the embryos of many animals, but at this time it becomes clearly distinguishable in its appearance.

Accompanying this development is a straightening of the embryo as described by “*sawwa*”. During this period, the embryo becomes more erect and acquires a more evenly rounded body. Some

of the generalized cells of the embryo begin to differentiate into various lines and modify into different functional moieties. This process results in straightening and the formation of organs necessary for viability. As the Qur'an describes:

«الَّذِي خَلَقَكَ فَسَوَّاكَ فَعَدَلَكَ» (سورة الإنفطار ٨٢ : آية ٧)

"Who (God) created you, then (fa) made you even and straight (sawwak) and then (fa) modified you ('addalak)" (Surah Al-Infitar, 82: Ayah 7).

According to Table 1, which compares three ayat on the stages of development, it is apparent that the *izām* stage corresponds with the straightening stage (*taswiyah*). The word of sawwak in the Qur'anic statement indicates the following:

- (a) To straighten the position of the body from a bent position.
- (b) To make uneven things leveled.

The embryo at the 7th week has a bent back thus taking the shape of the letter C during the *mudghah* stage. In the *izām* stage, the bending position is straightened and the surface becomes more even due to the disappearance of prominences and depressions.

D. The lahm stage. Although precursor cells (myoblasts, or primitive muscle cells) are present adjacent to developing bone (Figure 16), differentiation into skeletal muscle attachments occur after the ossification process in the shaft and ends of the bones has begun. A major developmental landmark during the eighth week is the lahm stage, which describes the myogenesis (muscle formation) period, and which marks the development of definitive muscles in the trunk and limbs and the beginning of movement. The muscles take their position around the bones ("clothing the bones") and continue the process of straightening and smoothing (*taswiyah*) which began in the *izām* stage. It is now known that the gonads (sex glands) begin to differentiate into testes and ovaries at this time (8th week), and the Qur'an refers to this development as well (See Table 1).

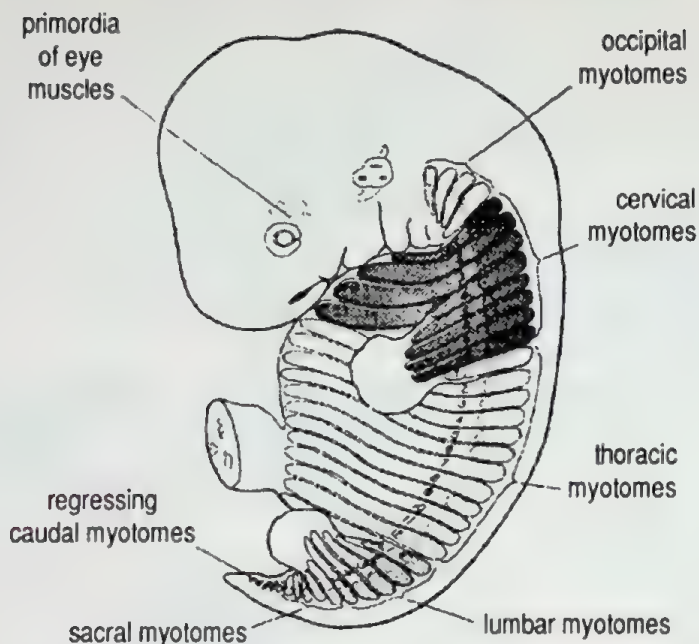


Figure 16. Embryonic myotomes, or segments, from which musculature arises, during the lahm stage (51 days). (Reprinted with permission from Patten, 1968)

VI. The growth (*nash'ah*) stage.

The lahm stage represents the end of the embryonic period during which much of organogenesis (organ formation) occurs. The Qur'an uses the word *khalaqna* (translated as "made" or "changed" in Ayat 13,14 in Surah Al-Mu'minoon (23)) in referring to all of the embryonic stages. *Khalaqna* indicates that new organized tissues are being formed in these stages. However, with the 9th week, the period of fetal development (*nash'ah*) begins. The Qur'an clearly distinguishes the beginning of this period by using the word *ansha' nahu* in the following statement:

«ثُمَّ أَنشَأْنَاهُ خَلْقًا آخَرَ...» (سورة المؤمنون ٢٢: آية ١٤)

"Then We (*ansha' nahu*) cause him to grow and come into being and attain the definitive (human) form" (Surah Al-Mu'minoon, 23: Ayah 14).

STAGES	Al-Mu'minoon (23): 13,14	Al-Qiyamah (75): 37-39	Al-Infitar (82): 7,8
1. Nutfah (drop)	ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَكِينٍ We then placed him as a nutfah (drop) in a place of settlement firmly fixed.	أَلَمْ يَكُنْ نُطْفَةً مِنْ سَمِيٍّ يَنْتَنِي Was he not a nutfah (drop) or part of germinal fluid emitted or programmed.	
2. Alaqah (leech-like)	ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً Then We made the nutfah into an alaqah (leech-like structure).	ثُمَّ كَانَ عَلَقَةً Then he became alaqah (leech-like structure).	
3. Mudghah (somites)	ثُمَّ خَلَقْنَا الْمُرَّةَ مُضْغَةً And then We changed (created) the alaqah into a mudghah (chewed-like substance)	فَخَلَقَ And did God make (create) him.	الَّذِي خَلَقَكَ Who God created you.
4. Izam (bones)	ثُمَّ خَلَقْنَا النُّطْفَةَ عِظًا Then We made out of that mudghah izam (bones; skeleton).	فَنَسَفَى And then fashioned (straightened and smoothed) him.	نَسَوَافٍ Made you even and straight.
5. Lahm (muscles)	ثُمَّ كَسَوْنَا الْعِظَامَ لَحْمًا Then We clothed the izam with lahm (muscles).	فَجَعَلَ مِنْهُ الذَّكَرَ وَالْأُنثَى Then of him He made the two sexes male and female.	فَعَدَّلَهُ، فِي أَيِّ صُورَةٍ مَا شَاءَ رَكَّبَكَ. And then modified you, in whatever form (facial features) He wanted He put you together.
6. Nash'ah (growth)	ثُمَّ أَنشَأْنَاهُ خَلْقًا آخَرَ Then We caused him to grow and come into being and attain the definitive (human) form.		

Table 1. Correlation between Qur'anic statements regarding the major stages in human development.

Ansha' nahu, means “to initiate”, “grow and develop”, and “to rise and increase”. The interpreters of the Qur'an understood the following meanings for the Qur'anic passage:

- Development of the fetus into a creature capable of speaking, hearing and seeing.
- Breathing the spirit into the fetus.

A. Characteristics of the nash'ah stage.

The following characteristics are apparent in the nash'ah stage:

1. **Rapid growth and development**, which directly applies with the meaning of *nasha'a* as explained above. Directly after the lahm stage (9th week) until the 12th week, the fetus grows slowly, and then its growth becomes very rapid (Figure 17).
2. **Change in the nature of the fetus and development of his organs.** The skeleton develops from soft cartilaginous bones to more solid, calcified bones, and by the time of 12 weeks gestation, centers of ossification are present in most bones. The limbs become differentiated and nails can be detected on the fingers and toes. The proportional sizes of the head, body and limbs change and their relative proportions become more balanced, particularly between the 9th and 12th weeks. Lanugo hair (fine hair) appears on the skin, which is fully differentiated into epidermis and hypodermis by 12 weeks. The external genitalia begin to differentiate in the 9th week. Also, the testes begin their descent and the internal female genitalia (uterus, oviducts, vagina) develop. At this stage in the 12th week, a male fetus can be easily distinguished from a female on the basis of the external genital organs.

Voluntary and smooth musculature are established. Fetuses at this stage of development reveal (mimic) spontaneous movements, and reflex muscular contractions can be elicited by an external stimulus. In general, the overall physiological development of the nervous system parallels the maturation of the brain and spinal cord.

Primitive and instinctive responses, such as sucking and grasping, are subcortical functions and appear much later. Nevertheless, this stage of development represents an important transitional landmark for the fetus because of its reasonably well coordinated reflexes and movements which become progressively vigorous in time. Other delicate and subtle developments occur in the fetus, which has changed from its first creation (embryo) to another one (fetus) as the Qur'an described.

The Nash'ah Stage (Fetal Period)



Figure 17. The embryonic period ends at the end of the eighth week; by this time, the beginnings of all essential structures are present. The nash'ah stage is characterized by rapid growth and elaboration of structure. From the ninth to the twelfth week, development and growth proceeds slowly until the nash'ah stage is fully expressed in the twelfth week, after which the growth and development proceed rapidly. Sex is clearly distinguishable by 12 weeks. (Reproduced with permission from Moore, Keith L., *The Developing Human, Clinically Oriented Embryology*, 4th edition, Philadelphia, 1988)

3. **Extensive and continued development of organ systems.** The embryonic period, which ends with the lahm stage, is characterized by the gradual appearance of organs. The fetal period which follows is characterized by the preparation of the organ systems for the performance of their postnatal functions. As the interpreters mentioned, this is the meaning of the Qur'anic phrase, "*come into being and attain the definitive (human) form*", and thus the fetus is made into a creature capable of speaking, hearing and seeing.
4. **Acquisition of a soul.** According to the Islamic information, the soul comes to the embryo sometime after day 40 to 45 in development, as mentioned in a hadith related by Abdullah Ibn Mas'ood:
عن عبد الله بن مسعود - رضى الله عنه - قال حدثنا رسول الله - صلى الله عليه وسلم - وهو الصادق المصدوق، قال: 'إن أحدكم يجمع خلقه في بطن أمه أربعين يوماً، ثم يكون في ذلك علقة مثل ذلك، ثم يكون مضغة في ذلك مثل ذلك، ثم يبعث الله ملكاً يؤمر بأربع كلمات، يقال له: اكتب عمله ورزقه وشقى أو سعيد، ثم ينفخ فيه الروح.' البخاري ومسلم واللفظ له، وأبو داود والترمذي وابن ماجه وعبد الرزاق في مصنفه، وأحمد في المسند من طريق أخرى، وأبو نعيم في الحلية

"The Prophet (peace be upon him), the truthful and trusted, told us, 'In every one of you all components of your creation are collected together in your mother's womb by 40 days and in that it is an alaqah like that, then in that it is a mudghah like that. Then God sends an angel ordered with four instructions. He is told to record his (the human being now developing) deeds, his provisi... (future benefits), whether he will be miserable or happy, and then the spirit is breathed into him (the soul is acquired)" (17-26). The hadith indicates that there is some delay after the 7th week according to the use of the word thumma.

Embryological studies have not determined the acquisition of a soul to which the Qur'anic commentators referred. The nature of the soul is generally outside the realm of experimental science and is essentially unknown at this time to mankind. As God says in the Qur'an:

”وَيَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا“ (سورة الإسراء ١٧ : آية ٨٥)

“They ask thee concerning the Spirit. Say: ‘The Spirit (comes) by command of my Lord; of knowledge it is only a little that is communicated to you (O men!)’” (Surah Al-Isra', 17: Ayah 85).

However, what we do know is that there is a difference between life and the soul, although the nature of both is a mystery. A creature with a soul has self-awareness. On the other hand, the sperm and ovum are alive, since without life they would be unable to participate in fertilization.

When the fetus is capable of moving voluntarily from his own desire, as opposed to moving reflexively, this could be taken as evidence that he has acquired a soul. During the 10th week of development, for example, the fetus exhibits spontaneous movements and moves in response to stimuli. While these movements may reflect primitive neurological reflexes and do not present conclusive evidence of the presence of a soul, they do indicate that the soul may be acquired near this time, and this would be in agreement with the time frame presented in the Islamic statements.

Thus the word ansha'nahu, as it is used in the Qur'an, covers the most apparent external and internal developments and changes in features in this stage of human development. The three meanings given for nash'ah comprehensibly apply to this stage; “to initiate” applies with the initiation of the functioning of various organs systems, e.g. the kidneys begin to form urine, blood cells begin to form

in bone marrow, hair follicles first appear in the 10th week, etc.; "to grow and develop" applies with the rapid growth and the extensive development of all the organ systems of the body which occurs during this stage; and "to rise and increase" applies with the very rapid increase beginning in the 12th week in the length and weight of the fetus. Therefore the term of nash'ah appropriately and accurately applies to the fetal period of development.

VII. Timing of the developmental events. Not only is the sequencing of the embryonic and fetal developments indicated by the order in which they are mentioned in the Qur'an, but also the timing of these events is indicated by the use of the conjunctives *fa*, which means "then with little delay", and *thumma*, which means "then with some delay". The occurrences of *fa* and *thumma*, both of which are translated as "then", are as follows:

"We (God) created man from a quintessence of clay. We then (thumma) placed him as a nutfah (drop) in a place of settlement, firmly fixed, then (thumma) We made the nutfah into an alaqah (leech-like structure) and then (fa) We changed the alaqah into a mudghah (chewed-like substance), then (fa) We made out of that mudghah, izam (skeleton, bones), then (fa) we clothed the skeleton with lahm (muscles, flesh), then (thumma) We caused him to grow and come into being and attain the definitive (human) form. So, blessed be God, the best to create" (Surah Al-Mu'minoon (23): Ayat 13,14).

The use of *thumma* indicates that there is a delay between the following events:

1. Nutfah stage developing into the alaqah (first stage of the shaping (khalq) stage).
2. Lahm (last stage of the shaping (khalq) stage) until the development of the nash'ah (fetal) period.

During the implantation or harth phase of the nutfah stage, there is a slow rate of development until the alaqah stage. It takes about a

week from the beginning of harth (day 6) for the connecting stalk to form (day 14), such that the embryo becomes “attached and hanging”, and it takes about 10 days for the notochord to begin development (day 16) in order for the embryo to take on the appearance of a leech or alaqah. Thus there is some delay in the formation of the alaqah stage.

The nash’ah or fetal stage can be considered as beginning in the 9th week, but is delayed in the expression of all of its characteristics until later. For example, the period between the beginning of the 9th week and the end of the 11th week is a period of relatively slow growth, and it is not until the 12th week that the rapid growth indicated by “ansha’ nahu” begins. Additionally, the initiation of the development of certain organ systems occurs after the 8th week, or after the lahm stage, but the changes in these organs become more apparent after the 11th week. Thus, there is a delay until the 12th week for the full expression of nash’ah, and the word *thumma* accurately indicates this delay.

The word *fa* indicates that the following stages occur directly after one another:

1. Alaqah changing to mudghah.
2. Mudghah changing to izam.
3. Izam changing to lahm.

The embryo at 24-25 days is in the end of the alaqah stage, and it makes a direct change into the mudghah stage at 26-27 days. The mudghah stage lasts until the 6th week, and then changes directly into the izam by the beginning of the 7th week, since the skeleton begins its appearance at that time. The lahm stage follows in the 8th week immediately after the izam stage, since muscle precursor cells begin their development into muscle as soon as the bone is formed and the muscles can become attached. Thus, the word *fa* is used in the Qur’an to accurately and strongly indicate that these developments follow one another immediately with no delay.

VIII. Conclusion.

The terms which have been used in the Qur'an are very descriptive of developments which occur in the various stages, and they describe these events in their chronological order. Morphological changes that occur with development in each stage are also accurately described by the use of these terms.

Because the staging of human embryos is complex, going through a continuous process of change during development, it is proposed that a new system of classification could be developed, using the terms mentioned in the Qur'an and Sunnah. The proposed system is simple, comprehensive and conforms with present embryological knowledge.

These facts about human development could not have been known by Muhammad (peace be upon him) in the 7th century, because most of them were not discovered until the 20th century. Muslims and others are justified in concluding that these facts could only have been revealed to Muhammad (peace be upon him) by God, Who knows all about us - not only about how we develop but how we live and function.



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